Virtual Hand Realism Affects Object Size Perception in Body-Based Scaling

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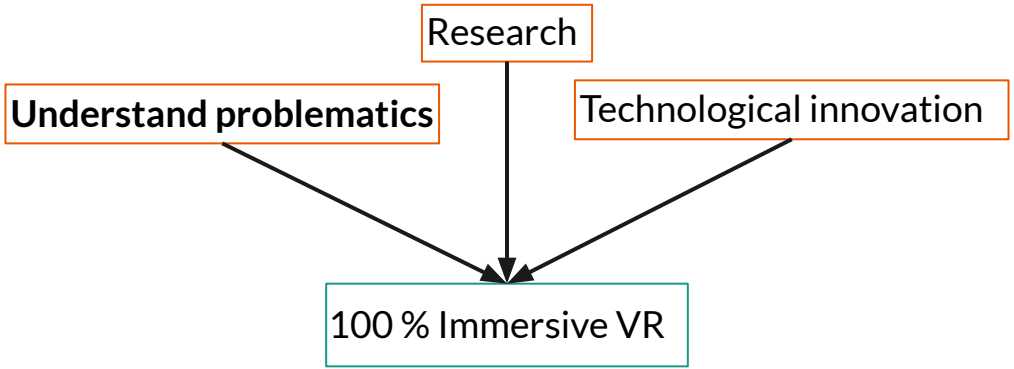
Paper selection

- Virtual reality (VR) - “is a computer simulated experience that can be similar to or completely different from the real world”.



Introduction of the problem

- It is important to identify and analyse the effects of avatars on user perceptions.
- The appearance of virtual hands influences our sense of embodiment.
- A hand very similar to a human hand we have a stronger sense of ownership of the body
- The size of the object is affected by the size of the body -> body-based scaling -> Increasing the size of the virtual hand results in decreasing the perceived sizes of objects.
- The more realistic the virtual hands are, the stronger the sense of ownership of the body, which promotes sizing.
- This paper is the result of the investigation of the effect of virtual hand realism as the size of a virtual object is perceived based on the size of the virtual hand.

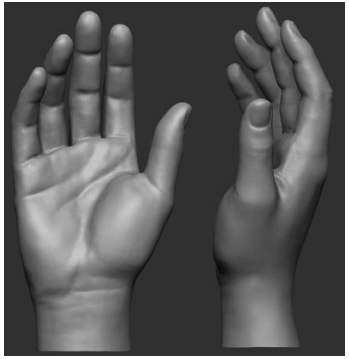
Important effects

Effect of Avatar Realism on Self-body Perception:

- Rubber hand illusion (RHI)
- Virtual hand illusion (VHI)
- The more similar the avatar is to us, the stronger the sense of ownership of the body
- a realistic virtual forearm increases the sense of ownership

Effect of Body Representation on Spatial Perception:

- The change in body size influences the perception of distances and size in the virtual world
- Uncanny Valley effect



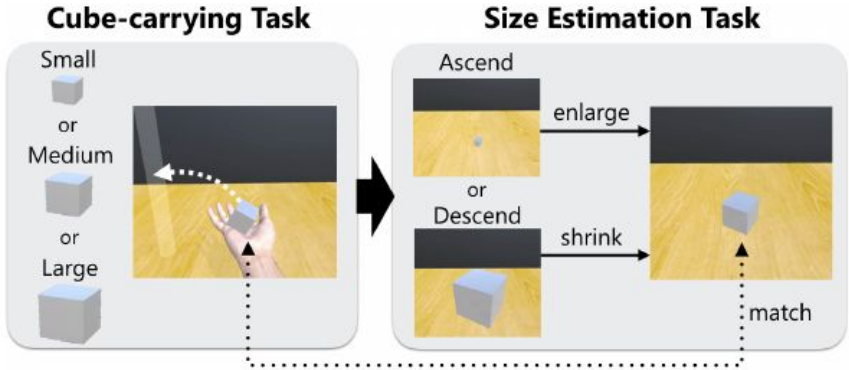
Generic 3DCG virtual hands

Expected Result

- H1 -> The object size is perceived to be smaller with the enlarged virtual hand than with the veridical virtual hand when the virtual hand is realistic.
- H2 -> The less realistic the virtual hands, the weaker the sense of body ownership.
- H3 -> The less realistic the virtual hands, the less the impact of changes in hand size on the object size estimation.
- H4 -> The participants with higher scores of body ownership tend to perceive the object size as smaller when the virtual hand is enlarged.

Experiment

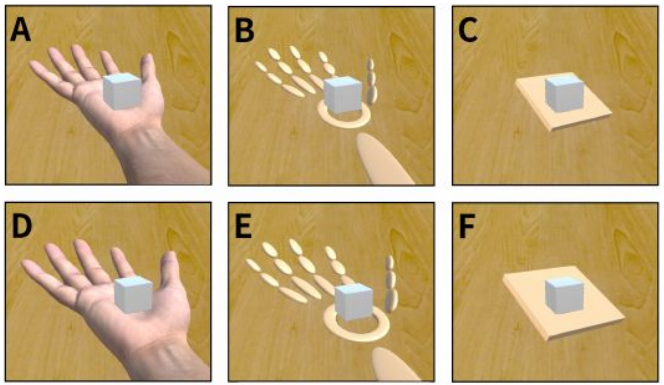
- It inverts how the size of a virtual object is perceived based on the size of the virtual hand.
- To do this, the participants transported cubes to a cylinder and then, using a controller that adjusts the size of the cube, tried to create a cube of the same size.
- Participants: 24 people -> 12 men and 12 women (20 to 36 years old).
- The device they used had the ability to detect the person's hand and arm to create avatars of the same size.



Experiment

Three types of hands:

- Realistic hand (High realism).
- Robotic hand (Medium realism).
- Abstract hand (Low realism).



Two types of hand sizes:

- Veridical size.
- Enlarged size.

Cube sizes:

- Small (5 cm);
- Medium (7.5 cm).
- Large (10 cm).

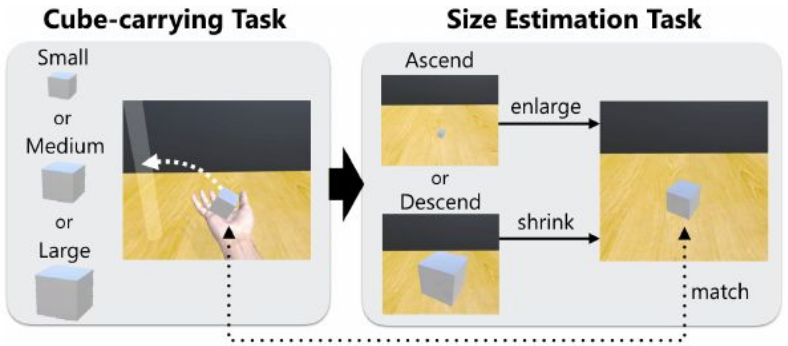
Size-adjustable cube:

- 1 cm (ascending series) to 15 cm (descending series).

Experimental Procedures

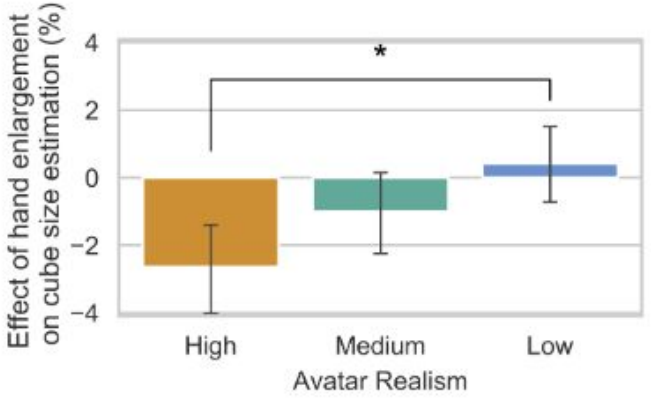
Two Parts:

- First participants carry randomly sized cubes to a cylinder with virtual hands.
- Second with a command the participants adjust the size of the cube.
- These tasks have no time limit and for each experiment the difference in size between the cube in the hand and the cube drawn was recorded.
- Questionnaire with 9 questions and answers from -3(strongly disagree) to 3 (strongly agree).
- 22 valid data sets.

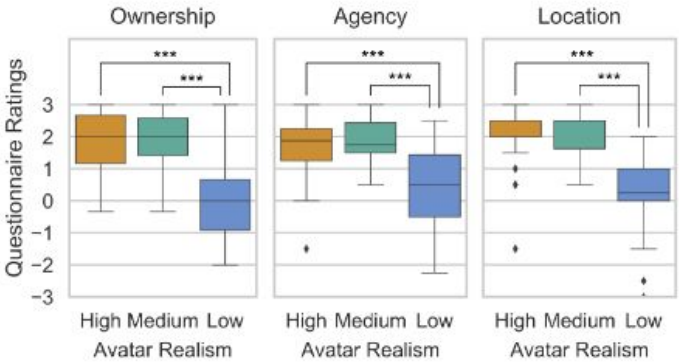


Results

- The hand enlargement caused the object to look smaller with the realistic hand [H1].
- The less realistic the virtual hands, the less the impact of changes in hand size on the object size estimation [H3].



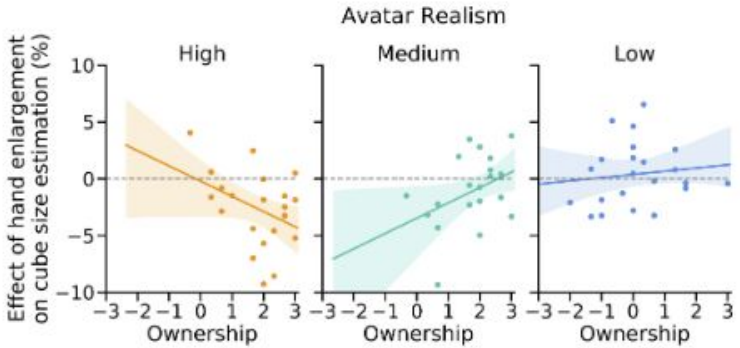
- The less realistic the virtual hands, the weaker the sense of body ownership [H2].
- Medium level of realism was similar to the high level of realism.



Results

These results did not fully support [H4]

- a negative correlation was found for the high-realism avatar, as expected, but the opposite was found for medium-realism avatar.



Conclusion

- The results showed that “perceived object sizes are underestimated only when a realistic virtual hand is used in the case where the virtual hand is enlarged”.
- Also, the sense of embodiment (including body ownership) is strongly affected by the realism of the avatar.

The size of body representation in VR is a fundamental metric to scale the size of objects properly

- To end, self-avatar appearances strongly affect how we perceive virtual body and also virtual spaces.

Bibliografy

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